Case Study

National Resources Conservation Service (NRCS), USDA

Bringing agriculture to the Internet

"This world of Web computing with distributed processes is leading-edge stuff. It gets natural resource information about clean water and green grass out to the public. It's about using high tech to promote conservation — which is important to everybody."

Wendall Oaks, Resource Data Gateway Project Leader, National Resources Conservation Service, USDA

Before daybreak on a farm, there's a light in the kitchen window. Inside, a farmer is analyzing climate patterns and studying soil erosion statistics — all at the touch of a few keystrokes. Welcome to 21st-century farming, thanks to the Natural Resources Conservation Service (NCRS) link on the United States Department of Agriculture (USDA) Web site.

Today, the Internet promises to be the most valuable tool for protecting America's vital natural resources. And the NRCS, working together with Compaq Computer Corporation, Microsoft and the Environmental Systems Research Institute (ESRI), is making it happen with a state-of-the-art, geo-spatial gateway (http://lighthouse.nrcs.usda.gov/lighthouse/index.html).

Business results:

> High-volume system for geo-spatial data delivery with centralized data

> Highly reliable, scalable, and flexible load-balanced system

> Online system that replaces paper-based documents and time-consuming research process

> Public access via the Web through one portal to multiple resources

> System to manage thousands of external and internal requests every day

> Model for other federal agencies looking to facilitate the delivery of information and provide easy access to their information through an online portal

Located in Fort Collins, Colorado, the NRCS Information Technology Center is responsible for developing Web-based natural resource database applications. Since the mid-1930s, the NRCS has helped farmers and ranchers develop agricultural and conservation systems. But while the NRCS had vast storehouses of information, it was not easily accessible to the public. To provide better service, the NRCS decided to create a Web-enabled, centralized repository of geo-spatial and tabular natural resource data.

The Lighthouse Project

In January 2000, the NRCS began a pilot program called the "Lighthouse Project" — a joint effort with Compaq and Microsoft to design and implement a system that offered easy online access to Geographic Information Systems (GIS) as well as geo-spatial information. The goal was to integrate three prototype applications using emerging technologies. If successful, this one-stop service would reduce paper-based maps and information, while continuing to support 3,000 field offices, 13,000 employees, and thousands of individuals who rely on the USDA for technical assistance and conservation planning information.

To realize this vision, the NRCS needed to access large data sets using Web-based applications on powerful equipment that could eventually scale to an enterprise level. Because building maps and navigating in real time over the Internet had never been done before on this scale, the effort was monumental.

The Lighthouse Project combined three ongoing Business Process Re-engineering projects to manage and deliver enterprise data from the USDA and other federal data providers using off-the-shelf applications, including:

> **Resource Data Gateway** — the portal that acts as a single access point for all natural resource information

> **Customer Service Toolkit** —a collection of professional software tools to map and analyze natural resource data

> **Soil Data Viewer** — a custom Internet application that provides online access to soils information

Building an agriculture architecture

Under the joint leadership of Wendall Oaks, Resource Data Gateway Project Leader, National Resources Conservation Service, USDA; and Steven Ekblad, Toolkit Development Team Leader, USDA; the NRCS team worked closely with a Compaq Global Services team and Microsoft Consulting Services. They designed an architectural framework for accessing applications and data in a client/server model.

"At the NRCS, we needed to produce a product to deliver data and information to USDA field offices," says Oaks. "In order to accomplish this objective, we partnered with Microsoft and Compaq to resolve technical issues associated with very large data sets."

The technical architecture was designed using Compaq Services Architect Methodology (CSAM), which is the Compaq approach to defining, implementing, deploying and evolving complex information systems. This process enabled Microsoft to take the next step: build a detailed software solution.

"When you have a complex project like this, you have to lay down a good road map to keep the project on track," says Oaks.

Scaling for millions

With a future potential of millions of users, the solution had to scale — big time. To test scalability, the team selected the Microsoft Windows 2000 Advanced Server operating system and Microsoft SQL Server 7.0 running on Compaq *ProLiant*™ 8500 systems.

The plan was to intentionally overload the hardware and use the metrics to determine how much hardware was required to scale up to a national deployment level. Oaks explains

the challenge of testing the limits in pilot mode, "When you build this kind of a system, you need to take some risks and live on the edge."

The retrieval of mapping data involves the combined geo-spatial technologies of Microsoft's TerraServer Web site for navigation and ESRI GIS software. Supported by Compaq hardware, the TerraServer is one of the world's largest online databases, providing a vast data store of maps and aerial or ortho-image photographs. Connecting to the TerraServer gave the NRCS the opportunity to leverage existing online image resources and build a link, using TerraServer imagery as a base layer for local mapping data.

The TerraServer database is hosted on a four-node Windows 2000 Datacenter cluster in Redmond, Washington. Each processor in the cluster is the same: a Compaq *ProLiant* 8500 system with eight 700 MHz processors and four GB of RAM.

ArcIMS (Internet Mapping Service) from ESRI was used to deliver high-end GIS and mapping services via the Internet. ArcSDE (Spatial Data Engine) server software provides the bridge to work directly with the SQL Server 7.0 database to deliver and store spatial data.

Delivering data in real-time

Part of the agency's mission is to provide soil mapping and correlation for every county in the United States. For the pilot, the team used data from 14 counties and gave the pilot its test drive in October 2000 — just ten months after the initial meeting. "Every step was critical, and every partner had a critical role," comments Oaks.

Using the pilot system, users could go to the Internet, navigate to a specific location, and then quickly generate soil-interpretative maps and reports using the latest GIS technology. Starting with a user request in the Resource Data Gateway, users could download both complex GIS images and detailed tabular data from customized queries — within minutes of access.

Citing the importance of this project, Oaks says, "This world of Web computing with distributed processes is leading-edge stuff. It gets natural resource information about clean water and green grass out to the public. It's about using high tech to promote conservation — which is important to everybody."

Pilot becomes operational

After the Resource Data Gateway solution was piloted and the NRCS team was satisfied with its results, it became operational. In addition, the NRCS team will be taking what they learned with the Web Soil Data Viewer into a telecommunications pilot in New Mexico, where they will evaluate its use with high bandwidth solutions.

Thanks to the efforts of the NRCS, what was once a tedious process to gather soils data and other resource information will be at the fingertips of those who make a living off the earth. As a result, today's farmer can determine what kinds of crops to plant and how to minimize soil erosion. Environmentalists can learn more about soil conservation. And others, such as town planners, can research ways to protect the wetlands and other valuable ecosystems.

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